Two-in/Two-out Standard Operating Procedure for the Saginaw Fire Department

Strategic Management of Change

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ABSTRACT

This research project analyzed the two-in/two-out provision of OSHA Respiratory Protection 29 CFR 1910.134. The problem is, the Saginaw Fire Department currently doesn't comply. Additionally, our current organizational structure staffing cannot comply with the two-in/two-out provision with all first on scene companies without waiting for reinforcements to arrive to begin interior structural fire fighting.

The purpose of this research project was to develop a standard operating procedure that requires compliance by October 8, 1998, and determine if all initial response companies should be able to begin interior structural fire fighting for fires at or beyond the incipient phase.

This project incorporated action, evaluative, and descriptive research (a) to determine what the Saginaw Fire Department and others currently do regarding the two-in/two-out rule, (b) to determine if the Saginaw Fire Department can improve fire fighter safety, (c) to determine what changes will be required for first on companies to be able to begin interior structural fire fighting and comply with the two-in/two-out rule without waiting for reinforcements, (d) to determine the driving forces and restraining forces presently relating to the required changes.

The procedures used with this research included a survey, the review of published articles, OSHA regulations, national standards, and departmental policy and statistics. They were used in making recommended changes and developing a new standard operating procedure for the Saginaw Fire Department.

The results of this research showed departments that comply will improve fire fighter safety and reduce death and injuries. Compliance can be achieved by first on scene companies waiting until

enough fire fighters arrive to enter structures or reorganize so all first on scene companies are staffed to be able to enter structures.

It is recommended from this research that the Saginaw Fire Department improve fire fighter safety by compliance with the regulation and a new standard operating procedure implemented to reflect the requirements. Also, that required changes occur within the organization so that first on scene companies can begin interior structural fire fighting without waiting for reinforcements to arrive.

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INTRODUCTION

The Saginaw Fire Department recognizes the inherent dangers associated with fire fighting and supports the idea of improving fire fighter safety. A rapid intervention team providing rescue and support to crews involved in interior structural fire fighting is one way to improve safety. This research project analyzed the two-in/two-out provision of OSHA's Respiratory Protection Act. This portion of the regulation requires that at least two employees are located outside the IDLH atmosphere during interior structural fire fighting in fires beyond the incipient phase, Respiratory Protection Rule (1998). The Saginaw Fire Department wishes to comply with all first on scene companies without waiting for reinforcements to arrive to begin interior structural fire fighting.

The problem is, the Saginaw Fire Department doesn't comply with the regulation nor does the current organizational structure allow all of our department's first on scene companies to be involved in interior structural fire fighting in fires beyond the incipient phase regarding the two-in/two-out provision. We have not staffed two of our four fire stations with enough fire fighters to allow first on companies in those two fire management areas to establish a standby or Rapid Intervention Team and begin interior fire fighting operations in structures with fires beyond the incipient phase.

The purpose of this research project was to develop a Standard Operating Procedure to reflect that the Saginaw Fire Department will comply with the two-in/two-out provision with all initial response companies. In addition, determine if we can implement changes to require an organizational structure that will allow all of the first on companies to be able to engage in interior structural fire fighting for fires beyond the incipient phase when the exceptions to the two-in/two-out rule do not apply.

Evaluative and descriptive research supported action research to answer the following

questions: 1) What do the Saginaw Fire Department and others currently do regarding the two-in/two-out rule? 2) Does the two-in/two-out rule improve fire fighter safety? 3) What changes will be required for first on companies to be able to begin interior structural fire fighting and comply with the two-in/two-out rule without waiting for reinforcements? 4) What are the driving forces and restraining forces pertaining to the required changes?

BACKGROUND AND SIGNIFICANCE

The Saginaw Fire Department operates four fire stations that cover approximately 18 square miles with a population of 77,508 (Michigan State Police, Fire Marshal Division, 1995-96). The department is staffed with career fire fighters operating on twenty-four hour shifts. We responded to a total of 7146 incidents which included 604 structure fires in the calendar year 1997 (City of Saginaw, FIR9, 1997). Structure fires that sustained $300.00 or more in damages were considered as fires beyond the incipient phase for the purpose of this report. There was a total of 180 such fires in 1997 (City of Saginaw, FIR145B, 1997).

Historically, we have moved to the notion of a rapid intervention team for interior structure fighting. However, we put the rapid intervention team in place only when the Incident Commander felt conditions were such that a team was necessary. Our policy did not require a Rapid Intervention Team assembled before entering a structure nor was a team required on all fires beyond the incipient phase and often we assembled a team after the interior crew had entered the structure. The OSHA Respiratory Protection Regulation requires that two fire fighters remain outside the structure when two or more fire fighters enter when the fire is beyond the incipient phase. Also, the two that remain outside must be on the scene before the entry.

From the Saginaw Fire Department's perspective, this study is justified because we will require many organizational changes in order for us to comply with the regulation. Although we believe that the regulations will improve fire fighter safety, compliance was voluntary before October 8, 1998 (Campbell, 1998). Michigan will require all fire departments in the State to comply after this date. Colleen Weber, City Attorney's Office (personal communication, April 21, 1998). The Saginaw Fire Department did not require compliance before the mandatory date because of the cost associated with supplying the additional work force required to comply without having to wait for reinforcements to arrive before interior structural fire fighting would be allowed. Along with the required increase in the departments overall complement of fire fighters and daily staffing minimums, many other organizational changes must take place. These changes must occur in staffing locations, vehicle placement, emergency response districts, standard operating procedures, tactics, and training.

This study directly relates the research to the Nation Fire Academy course, Strategic Management of Change, in that we can utilize the change management model as a tool to increase the probability of successful change within the department. The Strategic Management of Change course provided knowledge and skill to manage and lead change on the job (Federal Emergency Management Association, United States Fire Administration, National Fire Academy, 1996, p. xv).

One hundred and eighteen surveys were sent to Michigan fire departments serving a population of 15,000 or more. The survey gathered information regarding how eighty-four other fire departments in Michigan feel, and are reacting, to the OSHA regulations relating to the two-in/two-out provision. The change management model was used as a tool to guide the project. The results of this research show that the Saginaw Fire Department can comply with the two-in/two-out provision with

first on scene companies for all fires without waiting for reinforcements to arrive to begin interior fire fighting and recommends that the required changes occur within the organization. The changes will improve fire fighter safety, reduce death and injuries, and improve overall service (Manning, 1998).

LITERATURE REVIEW

On January 8, 1998, President Clinton pledged support and Secretary of Labor Alexis Herman and Assistant Secretary of Labor Charles Jeffress signed and released the new OSHA Respiratory Protection Regulations. These regulations replace the 1971 OSHA standards. The action signifies a tremendous victory for the IAFF and is probably the most important safety advance for fire fighters on the fire ground. The new regulation leaves no doubt that two-in/two-out is a fire fighter safety regulation that must be followed and is not debatable (Michigan Professional Fire Fighters, 1998, p.34).

The OSHA Respiratory Protection Final Rule became effective April 8, 1998 (New OSHA "Double Buddy" rule may effect Michigan fire departments, 1997-98).

Colin A. Campbell reported that Michigan is one of twenty-three states, through adoption of standards at least as stringent as OSHA regulations, that must comply with OSHA regulations six months after the agency does. OSHA estimated 5 million workers in 1.3 million workplaces, including firefighters, will be affected by the revised regulation. Also, that the two in/two out proposal was originally a tentative interim amendment to NFPA 1500, and was incorporated in the 1997 edition of the standard.

The International Association of Fire Fighters, which has long supported two-in, two-out, praised the regulation as an advance in firefighter safety. 'This regulation is a lifesaver for the men and women whose job it is to save lives,' said IAFF President Alfred K. Whitehead (Campbell, 1998, 12).

The National Volunteer Fire Council supports two-in/two-out as a fire fighter safety issue. Also, the OSHA respiratory standard and applauds OSHA for its efforts to increase fire fighter safety. NFPA 1500, 1997 edition, compliance will be the same as compliance with the OSHA rule ('Two In/Two Out' Codified by OSHA, 1998).

The small portions of the Respiratory Protection Rule that address the two-in/two-out issue is specific regarding the actions of fire fighters when involved in interior structural fire fighting.

(4) Procedures for interior structural firefighting. In addition to the requirements set forth under paragraph (g) (3), in interior structural fires, the employer shall ensure that: (i) At least two employees enter the IDLH atmosphere and remain in visual or voice contact with one another at all times; (ii) At least two employees are located outside the IDLH atmosphere; and (iii) All employees engaged in interior structural firefighting use SCBAs. Note 1 to paragraph (g): One of the two individuals located outside the IDLH atmosphere may be assigned to an additional role, such as incident commander in charge of the emergency or safety officer, so long as this individual is able to perform assistance or rescue activities without jeopardizing the safety or health of any firefighter working at the incident. Note 2 to paragraph (g): Nothing in this section is meant to preclude firefighters from performing emergency rescue activities before an entire team has assembled, Respiratory Protection Rule (1998, p. 1274).

OSHA states the new regulation will improve safety and firefighters will be among the more than 900 workers annually whose lives can be saved. However, many departments are not or are incapable of assembling the proper numbers needed to perform an "OSHA-legal" interior attack immediately upon arrival at a structure fire (Manning, 1998). What we have with the two-in/two-out rule is a tipping of the scale that balances between fire protection and firefighter safety a bit further in the direction of

firefighter safety. But, this unfunded mandate will force community leaders to decide whether providing the same level of fire protection to their citizens is worth the extra costs associated with OSHA's firefighter safety regulations (Anglone, 1998). In a question and answer formatted publication by the International Association of Fire Chiefs and International Association of Fire Fighters the issue is raised on how many rescue personnel will be required for each team operating in the interior of a structural fire.

The regulations do not require a separate 'two-out' team for each team operating in the structure. However, if the incident escalates, if accountability cannot be properly maintained from a single exposure, or if rapid rescue becomes infeasible, additional outside crews must be added. For example, if the involved structure is large enough to require entry at different locations or levels, additional 'two-out' teams would be required [29 CFR 1910.134(g)(4)] (International Association of Fire Fighters [IAFF], 1998, p. 5).

Another issue raised was how many firefighters were needed on the scene prior to starting interior structural fire fighting. "Depending on the operating procedures of the fire department, more than four individuals may be required" (IAFF, 1998). The OSHA standards reflect current respirator technology and use and cover issues of program responsibility, respirator selections and use, hazard evaluation, medical evaluation, fit testing, and training. If the standard applies to departments, compliance is recommended. Fire Department goals should be to comply with the regulations and more importantly be safe in a very dangerous occupation. "Of considerable controversy, and requiring a real behavioral change in our firefighters, is determining when they can enter an interior structural fire and when they can't." Training of Rapid Intervention Teams and fire fighting tactics will be a major

challenge for fire departments because in many cases they will be changing behavior and tradition (Edwards, 1998).

Recently, OSHA issued its long anticipated standard on respiratory protection. Of special interest, the "two in/two out" rule. Its proponents have identified this as a very significant change that will dramatically improve the safety of fire fighters and save lives. I agree and feel that in order to safely fight a fire of any significance, you will most certainly need more than four fire fighters on the fireground. Only time will tell the impact of this on the fire service. However, one thing is certain, we need to do something to change the way we currently do business and begin to see a significant decrease in our death and injury statistics (Marinucci, 1998, p.6).

In speaking about fire operation tactics, William C. Richmond, retired fire commissioner who served 28 years in the Philadelphia Fire Department, said, we need to consider the consequences before we act when fire fighters lives are endangered and that there is no room to gamble with human life (Richmond, 1998). Although it is dangerous for the fire fighter when interior fire fighting in structures is performed the two-in/two-out rule will help reduce the risk. Standard Operating Procedures must define what action is expected from fire fighters on the fire scene. The steps required for interior structural fire fighting must be defined. Freelancing will occur by incoming units and the Incident Commander will not have control. A written Standard Operating Procedure will help to establish control (Dyer, 1998).

Fire Service leaders need to improve the performance of their organization and to reduce the risks their communities, organizations, and individual members face every day. The environment in which fire fighters perform their duties has a significant level of risk of injury or death. The risk of injury

or death can be minimized through training, experience, protective clothing and equipment, implementation of appropriate strategies and tactics, and avoidance of unnecessary risks (Federal Emergency Management Agency, United States Fire Administration, 1996, p. 17).

The St. Louis, MO, Fire Department has shown that there is a real benefit to improving fire fighter safety. Through an accident prevention program, emphasizing engineering, education, and enforcement injuries have been reduced 70 percent since 1991 resulting in hundreds of thousands of dollars of savings for the city of St. Louis. An example of other benefits from a city that experiences numerous structural fires daily is that no fire fighter or fire company has been lost on the fire ground since an accountability system was implemented to improve safety (Gerner, Schaper, 1997).

Understaffed fire companies can't prevent a bad situation from getting worse. Hal Bruno recalls reviewing a fire report from a career department that the first-alarm response was two engines and a ladder truck with a total of seven fire fighters. The fire spread to adjoining buildings. They had the equipment but lacked fire fighters. After forty-five years of reading accounts of fire and other emergencies Hal sees not only a deficiency in the makeup of manpower but he suggests the fire service better document this in their fire reports to provide to others an understanding of the problems fire units and incident commanders face on arrival and subsequent alarms (Bruno, 1997).

An account of a fire fighter fatality in Lexington, KY reveals that the fire fighter was trapped for twenty or more minutes after falling through a floor with his partner during interior structural fire fighting. Entry was made into a vacant structure because a neighbor indicated that someone was trapped inside the structure. The second fire fighter was badly burned. The fire service has a proud spirit of rapid response to fires because of the quickness of fire spread. "That principle has been present and built on

for decades, and it can't be discontinued, but it should be reexamined." Fire fighters today have a protective enclosure from their equipment and clothing. In past years a fire fighter would not be able to advance into a structure with the extremely hazardous environments because of the heat and gas present would penetrate their gear. "So in a sense we are faster and more secure in our dress, but still we die with our hoods on." We not only need to be able to rescue civilians but our own fire fighters as well. A designated rescue team for fire fighters needs to become more common (Loeb, October, 1997, p.45). "In our fire operations, our greatest effort is in saving human lives. In this commitment we sometimes become victims ourselves and suffer the same fate as those we are trying to rescue." Fire fighting has always been dangerous but in the past we lacked self contained breathing apparatus, had limited knowledge in the science of combustion, and our protective clothing did not protect us as well as today. We also enter environments that contain materials vulnerable to fire that are more exotic, lethal, and explosive than ever before. Whatever we call this force, Firefighter Assistance and Search Team, Rapid Intervention Team, or replace the word team with crews, we should use a dedicated force to save our own and we may need to do it by compromise and adjustment (Loeb, November, 1997 p.60).

"No matter what your rank or how long your service lasts, never drop your guard. Always be aware of circumstances, for at a moment's notice, you can expect the unexpected" (Loeb, 1998, p. 66). Fire departments will need to develop or revise fire ground procedures to comply with the two-in/two-out provision or notify their governing body that they are unable to meet the standard and may not be able to perform interior structural fire fighting (Henderson, 1998).

Excuse me if I don't run a graph showing that firefighter deaths are going down or praise all the

NFPA standards and OSHA rulings for saving us. We all know there are not as many fires today, or as many firefighters. So of course the number of deaths is down. When I entered the fire service roughly 20 years ago, the NFPA reported 12,000 Americans died each year in fires. That number included 120 firefighters. Today, 100 firefighters go down for each 6,000 Americans who die in fires. The ratio used to be one firefighter for every 100 citizen deaths. Now it's one in 60. Is the job more dangerous today? (Stevens, 1998, p.8).

In a review of fire fighter fatalities in 1996 as in previous years, the largest number of deaths, 38 out of 94 total, occurred during fire ground operations. A review of the 1996 incident summary of the 94 deaths indicates that a Rapid Intervention Team may have affected the outcome of many of the fatalities. The summary of fourteen incidents involving fifteen fire fighter deaths, incident number 1, 6, 14, 24, 25, 26, 31, 46, 66, 68, 74, 81, 82, and 88 does not indicated if a Rapid Intervention Team was present, but with the story provided, it is obvious that a RIT would have been beneficial (Federal Emergency Management Agency, United States Fire Administration, 1997). "We have given of ourselves, often unto death, for the welfare of our citizens. It's time to recognize that we are at risk and as precious as those we serve" (Loeb, December, 1997, p. 70).

Greg Jakubowski, a registered fire protection engineer, a Pennsylvania state field instructor and Deputy chief with the Bryn Athyn, PA Fire Company makes a good point when he states that an accounting system for personnel may not seem important until a sudden unexpected event, such as a flash over, back draft or collapse, occurs (Jakubowski, 1998). Injuries and death to fire fighters can happen for several reasons such as improper size-up, lack of ventilation, insufficient water supply, poor communications, no accountability, and lack of manpower (Lasky, Marchese, 1998).

A review of the findings of others does show much support of the OSHA and NFPA two-in/two-out regulations. The increase in fire fighter safety is needed and this rule reduces the risk of death or injury to fire fighters when a Rapid Intervention Team is present.

The findings of what others are doing and their opinion about the two-in/two-out rule has influenced this project toward the development of a Standard Operating Procedure of requiring compliance from the Saginaw Fire Department without a reduction of services and to implement the required changes within the organization to accomplish this goal.

PROCEDURES

Definition of Terms

CFR. The Code of Federal Regulations.

IDLH (Immediately Dangerous to Life and Health). An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

Incipient Stage Fire. A fire which is in the initial or beginning stage and which can be controlled or extinguished by portable fire extinguishers, Class II standpipe or small hose systems without the need for protective clothing or breathing apparatus.

Initial Stage of Incident. During the initial attack when only one team is operating in the IDLH atmosphere of a structure fire. Once a second team is assigned or operating in the IDLH atmosphere the incident is no longer considered in the initial stage.

Interior Structural Fire Fighting. The physical activity of fire suppression, rescue or both inside of buildings or enclosed structures which are involved in a fire situation beyond the incipient stage.

NFPA. The National Fire Protection Association.

OSHA. The Federal Occupational Safety and Health Administration.

RIT (Rapid Intervention Team). A rescue crew available to perform assistance or rescue activities to the interior structure fire fighting team.

SCBA (Self Contained Breathing Apparatus). An atmosphere supplying respirator for which the breathing air source is designed to be carried by the user.

Standby Team. In the initial stages of an incident the two members outside the IDLH atmosphere performing either one of the following: (A) Designated and dedicated as a Rapid Intervention Team. (B) Performing other functions but ready to redeploy to perform as a Rapid Intervention Team.

Two-in/Two-out. At least four fire fighters are required on the scene and two fire fighters are located outside the IDLH atmosphere during interior structural fire fighting in fires beyond the incipient phase.

Research Methodology

The desired outcome of this research was to develop a Standard Operation Procedure to reflect that all initial response companies of the Saginaw Fire Department will comply with the two-in/two-out provision of 29 CFR part 1910.134. In addition, determine if changes can be implemented to require an organizational structure that will allow all of the first on companies to be able to engage in interior structural fire fighting for fires beyond the incipient phase when the exceptions to the two-in/two-out rule do not apply. Action research was supported by evaluative and descriptive research. The research was descriptive in that the current procedures of the Saginaw Fire Department regarding

interior structural fire fighting and the requirements of the two-in/two-out rule were identified. The research was evaluative in that the needed improvements were identified after analysis of procedures and requirements in an effort to improve effectiveness and safety. The information gathered was in the form of articles in professional publications, Saginaw Fire Department policy, internal departmental statistical data, federal regulations, and a survey.

The research was action in that the information gathered was used to develop a Standard Operating Procedure ensuring compliance with the two-in/two-out provision of the Respiratory Protection Rule to be used by the Saginaw Fire Department and other fire departments who wish to implement the required changes within their organizations. It also identified the changes necessary to comply and allow all initial first on scene companies to be able to perform interior structural fire fighting without waiting for reenforcements to arrive. The Two-in/Two-out Standard Operating Procedure developed by this research is shown in Appendix A.

One hundred and eighteen surveys were sent to Michigan fire departments serving a population of 15,000 or more (Michigan State Police, Fire Marshal Division, 1995-96). The populations served did represent small, medium, and large departments in Michigan. All departments surveyed served populations that were within 55,000 of Saginaw's with the exception of two, Detroit and Grand Rapids. Since Michigan has adopted standards at least as stringently as OSHA regulations, these rules will become effective for all departments surveyed on October 8, 1998 (Campbell, 1998). The survey gathered information regarding how other fire departments in Michigan feel, and are reacting, to the OSHA regulations relating to the two-in/two-out provision. Eighty-four surveys were returned by the requested date of May 31, 1998. A copy of the survey sent is included in appendix B and the results'

section of this paper contain the compiled answers to the survey questions.

Assumptions and Limitations

OSHA regulations allow deviations from the regulations only under specific exceptions in a known life hazard situation where immediate action could prevent the loss of life (International Association of Fire Chiefs, [IAFC], 1998). It is assumed that fire department responses to the survey sent for the purpose of this study understand this and will not operate under defacto standard practices. The survey was limited to Michigan fire departments and does not represent any fire department serving populations of less than 15,000 people. The survey was twelve questions with the first eleven requesting a yes or no response. Question twelve asked for a specific number regarding a manning issue. The survey attempted to determine how other departments were reacting to the two-in/two-out provision of the OSHA Respiratory Protection Rule.

This study was limited to the two-in/two-out provision which is a part of the section relating to the use of respirators within the Respiratory Protection Rule and it did not address many of the other requirements of the regulation such as exposure limits, respiratory protection programs, selection of respirators, medical evaluation, fit testing, maintenance and care of respirators, breathing air quality and use, identification of filters, cartridges, and canisters, training and information, inspector evaluation of training, program evaluation and record keeping (Pathfinder Associates, 1998). It is assumed that these individual issues regarding respiratory protection are addressed by all the organizations that require employees to use these devices during the performance of their duties.

The definition of the Rapid Intervention Team position and function is dependant upon if the incident is in the early stages or beyond the initial attack assignment. There is a distinction of what the

two-in/two-out rule requires of the two-out depending on what's the stage of the incident (Foley, 1998). This may cause confusion as to what activity by fire companies first on the scene actually constitute as compliance with the two-in/two-out regulation. This confusion may have an effect on the accuracy of the answers of the survey questions.

The results of this research relating to specific departmental changes needed for reorganization can only apply to the Saginaw Fire Department in that it is a unique organization as is any other fire department. Compliance with the two-in/two-out provision can be accomplished by waiting for reinforcements to arrive. This researched focused on compliance with the two-in/two-out rule by initial on scene companies without waiting for reenforcements to arrive. This will require at least four fire fighters on the scene before interior structural fire fighting can begin for fires beyond the incipient phase.

In the case where an emergency rescue is needed before the entire team (meaning four responders) is on the scene, such a rescue is permitted by the Respiratory Protection Rule in note 2 to paragraph (g) section (4) (Seymour, 1998).

The required changes within the Saginaw Fire Department and the driving forces and restraining forces pertaining to these changes are based on departmental statistical reports, knowledge based on experience, analysis of informal department policy, organizational structure and culture, the local political climate, and daily operations of the department.

RESULTS

The Standard Operating Procedure for the Two-in/Two-out rule is shown in appendix A. Implementation of the required changes to allow "OSHA legal" interior structural fire fighting by all first

on companies without waiting for reenforcements are recommended.

The results are related to the procedures in that documentation supports the ideas for change required by the Saginaw Fire Department in order to comply with the two-in/two-out provision of the regulations.

Answers to Research Questions

Research Question 1. The Saginaw Fire Department currently does not comply with the two-in/two-out rule. This project has influenced not only compliance by October 8, 1998 but, compliance without any reduction in service. 118 Michigan Fire Departments serving populations of 15,000 or more were surveyed as to what they do in regards to the two-in/two-out rule. Most of the departments that answered the survey currently comply with the rule. "For those in big city fire departments, and others who have been exceeding these standards for years, the question might be 'So what's the big deal?' (Angione, 1998).

Research Question 2. The two-in/two-out rule does improve fire fighter safety during interior structural fire fighting operations.

The action signifies a tremendous victory for the IAFF and is probably the most important safety advance for fire fighters on the fire ground. The new regulation leaves no doubt that two-in/two-out is a fire fighter safety regulation that must be followed and is not debatable (Michigan Professional Fire Fighter, 1998, p.34).

The International Association of Fire Fighters, which has long supported two-in, two-out, praised the regulation as an advance in firefighter safety. 'This regulation is a lifesaver for the men and women whose job it is to save lives,' said IAFF President Alfred K. Whitehead (Campbell, 1998, 12).

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OSHA states the new regulation will improve safety and firefighters will be among the more than 900 workers annually whose lives can be saved (Manning, 1998).

In addition to other factors the NFPA determined that the lack of a rapid intervention crew contributed to the loss of one fire fighter. This was from an abstract of NFPA fire investigative report of a carpet store fire in Branford, Connecticut, on November 28, 1996 (Foley, 1998, p.307).

Research Question 3. Many changes will be required for first on companies to be able to begin interior structural fire fighting and comply with the two-in/two-out rule without waiting for reinforcements. This will require restructuring so a minimum of four fire fighters arrive first on the scene for all structure fires. The changes will require the relocation of two rescue vehicles. The elimination of two single engine company fire stations and require all stations to become multiple company stations. This will allow for an organizational structure that can comply with the two-in/two-out provision by all first on companies. The increase in staffing at two stations comes at the price of the reduction of staffing at the two other stations. It will also require the minimum daily staffing to be increased from twenty-two to twenty-three. We will need to hire two additional fire fighters to have 28 suppression personnel on duty per shift to reach the daily minimum of twenty-three when sick, vacation, and other leave time are accounted. Apparatus placement must be changed. Rescue One will move to Station Four and Rescue

Two will move to Station Three. These moves will result in four multiple company stations with a minimum of five fire fighters first on the scene. Station maintenance issues must be resolved because of additional duties of remaining personnel at Station One and Two. The running districts for both Rescues need to be changed to reflect their relocation. Also, study the purchase of equipment and the assignment of rescue response of Engine One and Two for cardiac and vehicle accident incidents. The study will determine if better service overall and maintaining medical incident response times in Station One and Two's fire management areas could result from limited medical response of these engines. The review of many published articles and a study of the regulations helped to develop a standard operating procedure relating to two-in/two-out rule for the Saginaw Fire Department. Also, this study compared current procedures with the regulations showing the need for additional training and consideration of alternate fire ground strategy and tactics. Additionally, the development of standard operating procedures that address rapid intervention teams specific activities and responsibility, a Mayday situation whereby a fire fighter involved in interior operations is trapped or lost, an accountability system where fire fighters entering structures will be monitored and accounted for, and a blitz attack tactic whereby the initial engine company on the scene does not establish a water supply and depends on the second on scene engine company.

Research Question 4. The restraining forces are individual attitudes against change, Stations Three and Four not wanting to house rescue personnel, learning new emergency running districts, the fear of unknown results of the changes, changing initial on scene tactics that have been in place for years, increased training without equal time considerations given to the work schedules, the loss of the task force at Stations One and Two, members remaining at Stations One and Two will experience an

increase in individual station duties because of the loss of personnel, the loss of stationed rescue vehicles in Station One and Two fire management areas could be perceived negatively by customers living in these areas, the cost of two additional fire fighters, the current minimum of 22 on duty will not provide enough fire fighters first on the scene from each station, Station Three living conditions may be crowded with additional fire fighters stationed there, and if the rescue or engine from Stations Three and Four are out on a call and an alarm of fire is reported the remaining apparatus may not have enough fire fighters to initially perform interior fire fighting.

The driving forces are CFR 1910.134 requires the Saginaw Fire Department to comply (Campbell, 1998). Four multiple company stations will eliminate only three fire fighters first on the scene at remote locations in the city where it could take several minutes for reenforcements to arrive. This move placing at least four fire fighters first on the scene will allow all first on companies to be able to perform interior structural fire fighting immediately. Centralized auxiliary apparatus placement is not currently possible because of limited space in the stations but it can be accomplished with the moving of the rescue vehicles , the water rescue boat could be located at Station Three which would result in better access to launch sites, and fire ground operations will be safer (IAFF, 1998, Campbell, 1998, Manning, 1998, Foley, 1998). The rescue response times in fire management areas three and four will improve, it may be politically attractive to have multiple company houses, the additional fire fighter (23) on duty will improve fire protection for the city, the third fire fighter on Truck Two will improve fire fighter safety, the increase in total fire fighters by two increases the strength of the fire department, the current overcrowding at station Two will be eliminated, the design of Stations Three and Four accommodate multiple companies, the decrease of rescue response times in fire management areas

three and four, and the ambulance company, Mobile Medical Response, is remote to Station Three and within Station One fire management area. Approximately half the time in 1997 the Saginaw Fire Department was above the minimum daily staffing placing four fire fighters on Engine Three (City of Saginaw, FI22, 1997). Half the time Engine Three, if first on the scene, could perform interior structural fire fighting using the modified blitz attack if Rescue Three is not responding from Station Three because of being on a rescue call.

Survey Return Results

The survey that was sent is shown is appendix B. Eighty-four of One hundred-eighteen, 71%, of the twelve question surveys were returned by the requested date of May 31, 1998. Many differences are noted in how individual departments are responding to the new regulations. Fifty-nine departments currently comply and sixty-six believe fire fighter safety is improved with the two-in/two-our rule. Only one of the departments that currently comply say that they would not if the rule was recommended rather than required. Fifty-eight have multiple stations responding to structure fires and forty-eight of these have single engine fire stations. Only seven of these have minimum manning of four on these engines. Approximately half begin interior structural fire fighting with one engine on the scene. Fifty-one plan to use the Incident Commander as a rescue person but only thirty plan to use the pump operator. Forty-four will have first on companies wait for additional units to arrive before interior structural fire fighting can begin. Only nine will change so that companies first on the fire ground can begin interior structural fire fighting without waiting for reenforcements to arrive. The Majority of departments, thirty-two, require four fire fighters on the scene prior to starting interior structural fire fighting. Some surveys returned were not answered completely, therefore some of the yes and no responses for specific questions do not total eighty-four. Ten departments that responded requested a copy of the results of the survey. Table 1 on page 22 shows the totaled responses for survey questions one through eleven. Question twelve did not request a yes or no response but asked what is the departments minimum number of fire fighters required on the fire ground prior to starting interior structural fire fighting when the OSHA exceptions to the two-in/two-out rule do not apply. Thirty-two use four, twenty-five use five, eleven use six, eleven use under four, four use over six, and one department did not answer. The percentage and proportion of departments responses to question twelve are shown in figure 1 on page 22.

Table 1.
Survey Question Results for Questions 1-11.

	Response		
Question Number	Yes	No	Not Answered
1	59	21	4
2	66	16	2
3	58	22	4
4	58	26	0
5	48	35	1
6	7	54	27
7	41	42	1
8	51	33	0
9	30	54	0
10	34	44	6
11	9	36	39

Standard Operating Procedure Rationale

The new changes and procedure will increase fire fighter safety and comply with the two-in/two-out provision of the regulations (Dyer, 1998, p.76). Not only will we comply, but all first on companies will be able to perform interior structural fire fighting during the initial stage of the incident without waiting for reinforcements to arrive. We can improve our performance and reduce risk (Federal Emergency Management Association, United States Fire Administration, 1996).

DISCUSSION

The Standard Operating Procedure, which represents the results of this research, reflects the functionality of safe operations with four members on the scene when the distinction is made between standby members and rapid intervention team as they relate to the stage of the incident.

NFPA Standard 1500, 6-5.4 makes clear the distinction between Rapid Intervention Team and standby members. The decision to use the pump operator as a potential Rapid Intervention Team member early on during an incident was derived from this section of the standard.

In the early stages of an incident, which includes the deployment of a fire department's initial attack assignment, the rapid intervention crew(s) shall be in compliance with 6-4.4 and 6- 4.4.2 and be either one of the following: (a) On-scene members designated and dedicated as rapid intervention crew(s) (b) On-scene members performing other functions but ready to redeploy to perform rapid intervention crew functions. The assignment of any personnel shall not be permitted as members of the rapid intervention crew if abandoning their critical task(s) to perform rescue clearly jeopardizes the safety and health of any member operating at the incident (National Fire Protection Association, 1997).

This authors initial reaction was that the pump operator was not a candidate for a rescue as a Rapid Intervention Team member because of the critical nature of the pumping operation at a fire incident. However, as a standby member during the initial stage of an incident it is practical and functional to use the pump operator. As the incident progresses and the standby members are replaced with a Rapid Intervention Team additional fire fighters on the scene will allow the pump operator to remain at the pump. It would seem that as the incident progresses the pump operations become more critical as does the requirement for rescue personnel. Therefore, during the initial stage of the incident

the pump operator could abandon pumping tasks to assist or perform rescue without jeopardizing the safety and health of the other fire fighters. Early in the incident the benefit of the pump operator leaving the operating pump panel to assist or rescue fire fighting team far outweighs the risk. The annual testing of our pumps helps to ensure their reliability. Two charged hand lines is all that will be operating and early in the incident the fire fighting team will not penetrate deep into the structure prior to the arrival of reinforcements. The pump operator would be relieved as a standby member once additional members arrive on the scene. Appendix A of NFPA 1500 developed by the Technical Committee on Fire Service Occupational Safety to assist users understand and interpret the mandatory provisions of the standard show an example of how a department might deploy a team of four members initially on the scene that includes using the pump operator as a standby member (Foley, 1998, p.74).

The Saginaw Fire Department will be required to comply with the OSHA Respiratory Protection Rule by October 8, 1998(Campbell, 1998). How we accomplish this regarding the two-in/two-out provision of the Rule must be decided. Four fire fighters are required on the fire ground prior to starting interior structural fire fighting (Foley, 1998). Fire departments respond to incidents based on staffing, location of stations, and type of department. Paragraph 6-4.4 requires the assembly of four personnel before beginning interior structural fire-fighting operations. This section, along with the text in paragraphs 6-4.4.1 and 6-4.4.2, provides the basis for the discussion of the 'Two In and Two Out Rule' (i.e., 29 CFR 1910.134 and 29 CFR 1910.120) (Foley, 1998, p. 73). First on companies with less than four members wait for reinforcements prior to entering a structure to comply with the rule. Waiting will be a reduction in service allowing the fire to progress unchecked in many situations. Fire

burns quickly and we need to react without delay (Loeb, November 1997). OSHA will not permit our two existing three man engine companies to perform interior structural fire fighting in most situations if they are the only company on the scene. If necessary, being able to perform interior operations with initial on scene companies is preferred. OSHA does allow exception to the rule if there is a known life safety risk. Often, it is not known if the structure is occupied or the location of the occupants is unknown by first on scene companies. The ability to comply and perform interior structural fire fighting with four fire fighters on the scene will require all apparatus to respond from their assigned fire stations when we would be at minimum staffing levels. For example, if Rescue Three is out on a medical call and there is a fire beyond the incipient phase is in Station Three's fire management area and the exceptions to the two-in/two-out rule do not apply interior structural fire fighting could not begin until additional personnel arrive after Engine Three. There is a possibility for this occur but not with great frequency. If we are above minimum staffing levels Engine Three would arrive on the scene alone with four fire fighters. They would be able to perform interior structural fire fighting and may consider using a modified blitz attack and not hook-up to a hydrant and allow the second engine in to establish a water supply. They would then have four fire fighters on the fire ground to perform interior structural fire fighting. Reorganization of the department will allow at least four fire fighters first on the scene at a minimum cost without a reduction is service and an increase in fire fighter safety (IAFF, 1998, Campbell, 1998, Manning, 1998. Foley, 1998). The change to all multiple company stations within the fire department allows first on companies to establish a water supply and begin interior structural fire fighting while reinforcements are still responding. Because of the quickness of fire spread it is critical that extinguishment begin as soon as possible (Loeb, November, 1997). Michigan Public Act No. 207

of 1941, as amended, places responsibility for fire incidents with the fire authorities. As fire authorities within the state of Michigan, knowledgeable in the fire sciences, we owe it to our communities to provide quality emergency services. "Fire is unique to most emergency responses in that it intensifies proportionally to its duration; consequently, any unnecessary delay yields a multiplying effect on the potential for fatal injuries and substantially increases property losses" (Michigan State Police, March, 1998).

In addition to increasing Fire Fighter safety by providing a rescue team if needed, we will maintain the current level of service by performing fire extinguishment as soon as possible stopping the multiplying effect of fire before it can become more disastrous.

RECOMMENDATIONS

The Saginaw Fire Department procedures should comply with the two-in/two-out provision of OSHA Respiratory Protection Rules. The organizational structure should reflect the ability of all first on scene companies to be able to perform interior structural fire fighting without having to wait for companies from other stations to arrive. This will provide compliance with the regulations requiring four fire fighters on the scene without a reduction in services. The Standard Operating Procedure developed from this research should be implemented by the Saginaw Fire Department and it will demonstrate compliance with the regulations. Training on the procedures should be given to all department members and the changes required within the organization should be communicated to the members and implemented. Specific details about relocation of apparatus and required time frames should be addressed. Additional procedural topics such as Mayday, Rapid Intervention Team, Blitz attack, and Accountability should be developed and implemented. These procedures will work along with and

enhance the Two-in/Two-out procedures.

The data collected supports the idea of a two-in-two-out rule to improve fire fighter safety. If two fire fighters perform interior structural fire fighting when the exceptions to the two-in/two-out rule do not apply we should recognize the risk and have assistance immediately available if necessary. Once the fire fighter enters an unoccupied structure it becomes occupied. Those fire fighters occupying that structure are our most valuable assets and we should take the necessary steps to protect our resources. We would not require entry into a structure with four on the scene but the Incident Commander can keep a bad situation from getting worse by extinguishment as soon as possible because of the quickness of fire spread. The fire may be to heavily involved for four to handle. Ventilation may be required first and more fire fighters may be required but extinguishment may be possible with four members, not less than four, on the scene. Therefore, we should make every effort to have a minimum of four fire fighters on the scene initially.

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APPENDIX A
SAGINAW FIRE DEPARTMENT

SUBJECT: Two-In/Two-Out

DATE: June 2, 1998

S.O.P.

I. Purpose:

To establish a standard procedure for compliance with the "2 In 2 Out" provision of OSHA Respiratory Protection 29 CFR 1910

II. Scope:

This procedure applies to all fire department personnel.

III. Definitions:

RIT (Rapid Intervention Team):

A rescue crew available to perform assistance or rescue activities to the interior structure fire fighting team. Multiple Rapid Intervention Teams may be necessary when there are multiple interior structural fire fighting teams.

IDLH (Immediately Dangerous to Life and Health):

An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere

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Incipient Stage Fire:

fire which is i the initial or eginning stage and whic ca be ontrolled or extinguished by portable fire ext ngu shers ass II standpipe or small s systems without the need for protec ve clothing or breathing apparatus

Initial Stage of Incident:

During initial attack when only one team is oper ng IDLH atmosphere of a structure fire Once a second team is assigne or operating n he IDLH atmosp ere the incident is no longer considered in the initial stage.

Interior Structural Fire Fighting.

The physical activity of fire suppression, rescue or bot inside of buildings or enclosed structures which are involved in a f e situa oeyond he ncipien stage

IV Responsibilities:

1 It will be the responsibility of the Fire Chief Assistant (ief to ensure overa omp ance of the epa ment

2 It will be the responsibility of the Battalion Chief n dent Commander o comply w h and ensure comp ance o all embers under heir command.

3. It will be the responsibilit of Company Officers to

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ensure compliance of this procedure

4. It will be the responsibility of members to carry out the requirements of this procedure

V. Procedure:

Interior structural fire fighting, where the fire is at or beyond the incipient phase, requires at least four members on the scene

2. A minimum team of two fire fighters is required to enter the structure.

3. All fire fighters engaged in interior structural fire fighting must use self contained breathing apparatus.

4. The fire fighting team upon entering the structure must remain in visual or voice contact with one another at all times.

5. Before a fire fighting team enters the structure during the initial stage, at least two standby fire fighters must be outside the IDLH atmosphere for assistance or rescue

6. The standby members shall be in full turnout gear and have immediate access to an SCBA. They will be responsible for maintaining a constant awareness of the number and identity of members operating in the hazardous area, their location and function, and time of entry

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'he standby members shal remain in radio, visual e, r a ine communication with the eam. In e ini a stages of an ncident the standby members can be either one of the following:

(A Designated and ded cated as a Rapid Intervention Team.

B) Performing other func ons but ready to redeploy to perform as a Rapid Intervention Team.

8 One standby membe shal be perm ed o perform o e duties outside of e hazardous area, such as apparatus perator, n dent mmander, or echnician or aid

9. T Incide t Commander will assign the nter or fire ghting team and standby members

0. On e second nter eam is operating in the IDL atmosphere the incident is no longer considered in e initial tage and Rap ntervention Team, (RI is required

11. The Rapid Intervent on Team, RIT members

(A Mus be we g self cont ined breathing apparatus a d be i the ready position outside the IDL atmosphere

O e Rapid Intervention Team, (RIT member mus monit r the re s ua on and have appropriate

APPENDIX A

retrieval equipment, back up line, portable radio, and maintain communications with the Incident Commander

One Rapid Intervention Team, (RIT), member may be assigned to an additional role, such as Incident Commander in charge of the emergency or Safety Officer, so long as this individual is able to perform assistance or rescue activities without jeopardizing the safety or health of any firefighter working at the incident.

12. The Incident Commander must be notified prior to Rapid Intervention Team, (RIT), entry into the structure.
13. Nothing in this procedure is meant to preclude firefighters from performing emergency rescue activities before four members arrive on the scene. A structure may be entered before four members arrive on the scene where immediate action can prevent the loss of life or serious injury
14. Any time interior structural fire fighting is conducted without four members on the scene this action must be documented in the Incident Commander's fire report and forwarded to the Fire Chief / Assistant Chief

APPENDIX B

Department Career Part-Paid Volunteer

Contact name and phone number

Survey regarding the "2 In / 2 Out" provision in OSHA Respiratory Protection 29 CFR 1910.

Please, circle the response that applies to your department.

1. Does your Fire Department currently comply with the "2 In / 2 Out" provision?

■ yes / no

2. Do you believe that the "2 In / 2 Out" provision will improve fire fighter safety?

■ yes / no

3. Would you comply with the "2 In / 2 Out" provision if it were only a recommendation?

■ yes / no

4. Does your Department have multiple stations responding to structure fires?

■ yes / no

5. Does your Department have single engine fire stations?

■ yes / no

6. If yes, does your Department have minimum manning of four personnel on these engines?

■ yes / no

7. Does your Department begin interior fire fighting, for fires beyond the incipient phase, with only one of these engines on the scene?

■ yes / no

8. Do you use, or plan to use, the Incident Commander as one of the rescue personnel?

■ yes / no

9. Do you use, or plan to use, the pump operator as one of the rescue personnel?

■ yes / no

10. Considering the "2 In / 2 Out " provision, do you have enough personnel responding from each station so companies first on the fire ground can perform interior fire fighting without waiting for additional units to arrive? (When the OSHA exceptions do not apply)

■ yes / no

11. If no, do you plan to change so that you have enough personnel first on the fire ground to perform interior structural fire fighting without waiting for additional units?
(When the OSHA exceptions do not apply)

■ yes / no

12. What is the minimum number of fire fighters on the fire ground, for your Department, prior to starting an interior structure fire attack for fire beyond the incipient phase?
(When the OSHA exceptions do not apply)

less than 4 4 5 6 more than 6